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MANPOWER FACTORS IN SYSTEMS ACQUISITION

By

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LOGISTICS AND TECHNICAL TRAINING DIVISION

Logistics Research Branch

Wright-Patterson Air Force Base, Ohio 45433

July 1981

Final Report

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This technical paper was submitted by the Logistics and Technical Training Division, Air Force Human Resources Laboratory, Wright-Patterson Air Force Base, Ohio 45433, under Project 1710, with HQ Air Force Human Resources Laboratory, Brooks Air Force Base, Texas 78235.

This technical paper has been reviewed by the Office of Public Affairs (PA) and is releasable to the National Technical Information Service (NTIS). At NTIS, it will be available to the general public, including foreign nations.

This technical paper has been reviewed and is approved for publication.

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER AFHRL-TP-81-14	2. GOVT ACCESSION NO. AD-A102429	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) MANPOWER FACTORS IN SYSTEMS ACQUISITION	5. TYPE OF REPORT & PERIOD COVERED Final	
	6. PERFORMING ORG. REPORT NUMBER	
7. AUTHOR(s) Gordon A. Eckstrand	8. CONTRACT OR GRANT NUMBER(s)	
9. PERFORMING ORGANIZATION NAME AND ADDRESS Logistics and Technical Training Division Air Force Human Resources Laboratory Wright-Patterson Air Force Base, Ohio 45433	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 62205F 17100434	
11. CONTROLLING OFFICE NAME AND ADDRESS HQ Air Force Human Resources Laboratory (AFSC) Brooks Air Force Base, Texas 78234	12. REPORT DATE July 1981	
	13. NUMBER OF PAGES 21	
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	15. SECURITY CLASS. (of this report) Unclassified	
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE	
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES Paper presented at the Aerospace Industries Association Symposium "Product Support - A Changing Challenge", held in Seattle Washington, 21-22 October 1980.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) acquisition logistics consolidated human resources technology human factors engineering human resources in design trade-offs integrated logistics support maintenance technical data manpower and personnel system ownership costing training weapon system acquisition		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This paper discusses the role played by Weapon System (W.S.) design and support planning decisions in determining manpower and related support requirements and how these requirements can be controlled by including them as criteria or constraints in the W.S. acquisition process. The historical disconnect, in the military services, between the system for procuring human resources and the system for procuring hardware resources is identified as a factor that has slowed the development of tools and techniques for including manpower, personnel and training factors in W.S. design decisions. Nevertheless, it is felt that a usable technology in this area now exists. The current status of this technology is briefly reviewed in the following areas: maintenance manpower modeling; training requirements analysis; maintenance technical data; system ownership costing; human resources in design trade-offs; and supporting data bases. The importance of integrating the application of these component technologies during W.S.		

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development is emphasized, and a proposed method for doing this is described. Even though a usable technology exists for including manpower factors in the process of choosing among W.S. design alternatives, achieving widespread application will not be an easy task. Some things which must happen before this can be achieved are discussed. Finally, the paper points out some favorable signs that manpower factors are beginning to receive the attention they deserve in W.S. acquisition.

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

AFHRL-TP-91-14

AFHRL Technical Paper, 81-14

11 Jul 1981

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Availability Codes
Dist Avail and/or
Special

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(Paper presented at the Aerospace Industries Association Symposium "Product Support - A Changing Challenge," Seattle, Washington, 21-22 October 1980)

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Manpower Factors in Systems Acquisition

The theme of this Symposium is "Product Support," and this Panel is addressing one very significant aspect of that support; namely the task of providing the skilled manpower to operate and maintain the product, in most cases a weapon system (W.S.), in a manner that will allow the system to achieve its operational objectives at an affordable cost. My particular paper is concerned with the role played by W.S. design and support planning decisions in determining manpower and related support requirements and how these requirements can be controlled by including them as criteria or constraints in the W.S. acquisition process. Now that I have staked out my territory, let me defend it -- defend it in terms of its importance as an area of critical concern for all of us who are involved with W.S. acquisition and modification. I think there is rather general agreement that W.S. acquisition decisions are a major factor in determining support requirements, and that these support requirements are large enough and important enough to warrant significant attention. In the Air Force, current logistics spending accounts for approximately 25% of the budget, and this excludes manpower, a substantial portion of which falls in the logistics area. For example, over 43% of all Air Force personnel are associated with logistics functions. And, I think it is safe to say that the systems we are developing today auger for still higher logistics costs in the future. Studies have shown that in most weapon systems, operations and support (O&S) costs exceed 50% of the total life cycle costs (LCC) and, in some cases, they may be as high as 80%. For example, in a recent study of the C-130E aircraft over a period of 15 years, O&S costs were 80% of the system LCC. Significantly, 64% of the O&S costs were manpower related costs. These trends have been exacerbated by the rising costs of military manpower associated with the change to an all-volunteer force.

With a relatively constant defense budget, these and related statistics have made it quite clear that manpower and logistics costs must be brought under control. This realization has brought about an increasing concern that the weapon systems procured by the military services be designed so that they can be operated and maintained effectively at a manpower and logistics cost which is in balance with other demands on the military dollar (e.g., development of new technology and new weapon systems). How can this be done? It can be done only if manpower and logistics considerations and costs become weapon system design parameters in the same sense that operational and performance considerations and costs have been in the past. Furthermore, because so many of the design decisions which drive support costs are made very early in the weapon system development process, it is necessary that manpower and logistics factors be addressable from the earliest phase of system acquisition on (Viewgraph 1). In fact, manpower and other logistic resource constraints should be identified in the mission element need statement (MENS).

However, ownership cost is only one criterion against which to evaluate W.S. supportability. More recently, there has been an additional concern. The concern is that the very ability of a W.S. to meet its peacetime readiness and wartime employment objectives may be critically dependent upon the extent to which W.S. supportability (including manpower constraints) has been considered during the W.S. acquisition process. If this relationship is confirmed, it certainly takes W.S. supportability out of the "nice to have" and places it in the "must have" category.

Applicable Policy Directives

Based upon this brief analysis, one would assume that logistic support factors, including manpower, personnel and training, would be receiving considerable attention in the W.S. acquisition community. Indeed, these factors have been the subject of a great deal of concern from high level personnel in the DoD, and this concern has been reflected in the issuance of numerous directives, regulations and memoranda. Some of these are listed on this viewgraph (Viewgraph 2).

Most of you are familiar with these documents, I am sure, so there is no need to review them here. A few comments, however, may be in order. Office of Management and Budget Circular A-109 laid out a new acquisition policy for major procurements throughout the government. This policy emphasizes the need for front-end analysis as a part of early system planning and definition. DoDD 5000.1 and 5000.2 implement A-109 within the DoD. These Directives make clear that support considerations, including manpower factors, are to be actively considered during system acquisition. For example, DoDD 5000.1 states: "The number and skill levels of personnel required and human engineering factors shall be included as constraints in system design." DoDD 5000.2 specifies that support cost as well as acquisition cost shall be included as design criteria. But it is the last three documents listed on this viewgraph which provide the real thrust for establishing manpower and logistics concerns as an inherent part of major system acquisition and which become specific about how and when these factors will be employed to influence requirements and design.

Thus far I have attempted to show that if we want to have supportable systems, support considerations must have an opportunity to impact design. I have further attempted to show that manpower, personnel and training are potentially major factors determining both the cost of W.S. support and the adequacy of that support for meeting system readiness objectives and that, therefore, there must be full integration of these factors into the W.S. acquisition decision making process. Finally, I have attempted to show that, at the present time, there are clear and specific directions that establish this as official DoD policy. Incidentally, in the interest of economy of speech, in the balance of the paper when I use the term manpower factors it should be understood to include manpower, personnel and training.

Slowness in Developing Needed Technology

With all of this official policy and direction, some if it of long standing, why hasn't there been greater compliance? Why don't manpower

factors play a greater role in the decisions and trade-offs that occur during W.S. design and support planning?

There are undoubtedly many reasons, but let's start with one of them, the responsibility for which resides with the human factors and human resources research community; a community which some of us here represent. There is no doubt that we have been slow in developing, demonstrating and marketing the tools and techniques that are required to conduct meaningful trade-offs among manpower, system characteristics and support concepts. The lack of research and development in this area stems, in part at least, from an unfortunate historical disconnect, in the military services, between two major procurement systems. The manpower-personnel-training system is responsible for procuring human resources. People are selected, classified, trained, utilized, sustained, separated and retired according to a plan designed to achieve certain personnel force objectives. The weapons development system is responsible for procuring hardware resources. Weapons and support equipment are conceived, developed, tested, evaluated, deployed, operated and disposed of to meet required operational capabilities of the services. But these two systems, the systems for procuring human and hardware resources, operate with greater independence than they should. They need to be interfaced more closely than they are at every stage of operation. They need to adopt a mutually accommodating mode of operation if the services are to meet their national security responsibilities effectively and efficiently. Before World War II, the relative independence of these two procurement systems was only an occasional inconvenience. But with the increasing sophistication of modern military weapons and equipment, it is essential that they be interactive, each influencing the other.

The disconnect between the military systems for procuring human and hardware resources has tended to produce a similar disconnect between the human engineering and the manpower, personnel and training research conducted by the military services and the aerospace industry. We have drawn a rather rigid distinction between human engineering research (which has been concerned with the effects of human capabilities and limitations on the design of equipment) and manpower, personnel and training research (which has been largely concerned with adapting the human to the constraints built into the equipment). Human engineering researchers generally have contented themselves with considering man's capabilities and limitations as relatively fixed; something to be measured, quantified and put into a design handbook. Manpower, personnel and training researchers have generally been content to accept the engineer's products as relatively fixed; something to be analyzed and described in order to specify the tasks for which people must be selected and trained. This existing rigid structure of specialization has been unfortunate and certainly has been one of the factors which has slowed the development of an effective technology for including manpower related requirements as criteria and constraints in the W.S. acquisition process.

Additionally, manpower related research and development (R&D) directed at impacting the W.S. acquisition process has frequently been caught in

organizational roles and mission conflicts, has had difficulty finding a home in the DoD R&D classification scheme, and has suffered from a lack of customers who are willing to document research requirements and provide cogent advocacy. Only recently have some of these problems been solved. Of the millions of dollars that have been spent on manpower related research in the past decade, only a tiny fraction has been allocated to research aimed at impacting W.S. design and development.

Current Status of the Technology

Nevertheless, in spite of all the difficulties and disincentives, considerable progress has been made in this area. A number of R&D programs have been initiated and sustained in spite of low budgets and an unenthusiastic management climate. I believe that the Air Force was the first service to initiate a systematic program of R&D aimed at the integration of manpower factors into the W.S. acquisition process. This program began in 1968, under the title "Human Resources Engineering" (a title, incidentally, which never caught on), and has been continued at a modest level until the present time. A few years ago the Navy, and more recently the Army, initiated programs in this area. Based upon the results of this research, I feel that a usable technology exists, and that this technology could and should be applied in all major W.S. acquisition and modification programs. There are some gaps and weak spots in the technology, but I feel that its application could make a significant contribution in assuring that the systems and equipment acquired by the military services are designed in such a way as to be compatible with the services' ability to provide human resources.

Let's take a brief look at some of the components of this technology (Viewgraph 3).

Shown in this viewgraph are some of the tools and techniques which have been developed or modified for use in the W.S. acquisition process.

Maintenance manpower modeling - This topic refers to techniques for estimating the maintenance manpower requirements for weapon systems. With current models, these estimates can be made at all stages of system development so that manpower requirements can be used as criteria or constraints in choosing among W.S. design and support planning alternatives as well as inputs to the preparation of unit manning documents.

Training requirements analysis - Training requirements and plans, of course, are products that must be developed concurrently with a weapon system. Here, however, I am referring to techniques for permitting training requirements to have an influence on W.S. acquisition decisions as well as to be influenced by them. I will have more to say about this a little later.

Maintenance technical data - Like training requirements and plans, the maintenance manuals for use by technicians on the job are products that are developed concurrently with the W.S. However, the maintenance technical data options available to support a particular W.S. acquisition have been

greatly expanded by recent R&D. Numerous formats and options are available for Job Guides and Proceduralized Troubleshooting Aids, and adequate specifications and handbooks are available to provide guidance to System Program Office (SPO) and contractor personnel in selecting and procuring technical data which are tailored to the characteristics of a particular system and to the needs of the maintenance personnel expected to be available to support that system.

System ownership costing (SOC) - This topic refers to systematic methods of estimating nonrecurring support investment costs and recurring O&S costs. In this way SOC provides the means to identify major cost contributors and to use this information as input in addressing and controlling W.S. life cycle costs.

Human resources in design trade-offs - This topic refers to an approach, using some form of design option decision tree, to identify design trade-offs and an impact analysis to quantify the effects of the various options on human resources and related support requirements. Since the W.S. design process can be looked upon as proceeding by a series of trade-offs, this capability is a powerful tool for having an impact on the selection of alternative designs.

Data bases - "Data bases" refers here to sources of data necessary to the application of the component technologies listed above. These models and techniques are heavily dependent for their successful application on the availability of historical data bases containing information which reflects field experience in the operation and support of various types of systems and equipment. Such data are currently available but are scattered and difficult to access. What is ultimately needed is a convenient, usable source of design related operating and support data using uniform methods and definitions throughout the W.S. life cycle.

I realize that this is only a brief overview, but there is not time here today to discuss each of these component technologies in greater detail. For more information on the current status of each, as well as near term and far term technology projections, I refer you to my recent technical report dealing with manpower and logistic factors in weapon system development.¹

However, because this particular Panel is emphasizing training for future product support, I would like to expand a bit on the training issue as it relates to W.S. design and development.

Instructional System Development (ISD) is the basic method used by the military services to determine training requirements and to develop training plans and programs. The techniques and procedures for ISD are well documented and are being applied widely with varying degrees of success. The strengths

¹ Eckstrand, G.A. Technology Projection: Manpower and Logistic Factors in Weapon System Development, AFHRL-TR-80-2, AD A088 314. Wright-Patterson AFB, Ohio: Air Force Human Resources Laboratory, Logistics and Technical Training Division, August 1980.

and weaknesses of the services' efforts in ISD are also well documented. Of particular interest here, however, is the availability of techniques for integrating training considerations into the system acquisition process in a way that allows them to influence requirements and design. Controlling training requirements can be as important as constraining manning levels during W.S. development. Here the technology is not well developed and responsibilities are fragmented between various commands. In the Air Force, for example, Air Force Logistics Command (Integrated Logistic Support Program), Air Force Systems Command (Human Factors Engineering Program), Operating Commands and Air Training Command are all involved. On the management side, there is a definite need to fix responsibility in this important area. In the R&D area, there is a requirement for techniques and models for accomplishing training impact analyses early in the W.S. development process. The ISD process, as currently documented, depends heavily on detailed task and situation analyses of the jobs to be trained. Such information, of course, is not available early in the system development cycle. This means that the training people supporting a W.S. development program tend to become actively involved only after all major design decisions have been made. This needs to be changed. Therefore, a prime requirement is to develop techniques and models which can accept other types of inputs; e.g., data from other systems, selected on the basis of comparability analyses, and data derived from expert judgment. We also need to improve our capability to develop these types of data in the training area. Some research has been done on the accuracy with which skilled maintenance technicians can estimate training requirements from design phase engineering descriptions of the system. Early results were disappointing but later work has shown that if the estimates are asked for at the proper level of detail, valid data can be obtained. This work needs to be followed up and supplemented with efforts to improve the use of comparability analysis in making early training requirements determinations.

It is important to recognize, however, that for any progress to be made in our ability to have training influence system design, we must change our attitude toward training as an element of W.S. support. The current attitude regards training solely as a mechanism for conforming people to the hardware design, and, not infrequently, training is expected to make up for poor design. With changes in the input skills of first-term officer and enlisted personnel, with increasing turnover rates and the rising costs of training, we must take a more positive stance toward designing systems which require skills which are compatible with the services' ability to provide skills.

Up to this point, we have been discussing component technologies. I would like to shift now to the need for integration.

Each of the component technologies discussed above, with the exception of Human Resources in Design Trade-Offs, is currently being applied to some extent in the development of weapon systems. Each of the technologies is making a contribution to improving the supportability and reducing the cost of ownership of these systems. However, the technologies are not being applied in the most cost effective and efficient manner. Some of the technologies are applied too

late in the weapon system acquisition process to have a significant impact on design. Each of the technologies operates from its own data base even though there is considerable overlap in the nature of the required data. Most seriously, the technologies are applied separately with little regard for the obvious interrelationships which exist among the factors being considered. As is so typical of much of human factors engineering in its application to W.S. development, we have been developing and applying tools and techniques for suboptimization.

What is needed is a method to integrate the application of these component technologies during W.S. development. Application of the technologies should begin in the conceptual phase and should continue in a coordinated manner during all phases of W.S. acquisition. Furthermore, a consolidated data base should be defined which can satisfy the requirements of all the component technologies. This kind of integrated and coordinated application will be required in order to assure continuous and comprehensive consideration of manpower factors and their associated costs throughout the W.S. acquisition process. Only in this way will it be possible to make the trade-offs required to optimize a W.S. in terms of the human resources support posture which it requires.

The Air Force Human Resources Laboratory (AFHRL) has been carrying out, since 1976, an advanced development project to develop and demonstrate a Coordinated Human Resources Technology (CHRT) which will achieve this objective. The CHRT methodology was designed to integrate the five technologies and complement the proven capabilities of each (Viewgraph 4). CHRT extends the application of these technologies throughout W.S. acquisition and provides compatible assessment and product development functions. The main features of CHRT are shown on this viewgraph (Viewgraph 5).

As an assessment methodology, CHRT uses models and procedures to develop and systematically assess system design and support plan alternatives. The models and procedures extend the analytical capability of the individual technologies into the early phases of acquisition where assessment capability is most needed. Assessments are quantified in terms of human resources, logistics and cost.

As a product development methodology, CHRT provides an integrated approach to developing the training and technical manual products required to support the weapon system design and implement the support plan. It also produces preliminary manning documents.

Finally, CHRT is supported by a single consolidated data base (CDB) prepared for the weapon system under consideration. This data base contains, at a single location, all data required to achieve the aims of the five technologies as integrated in CHRT.

The CDB is weapon system specific and provides a planned procedure and structured format for obtaining the data required by the CHRT methodology. The CDB consists of data groups and files which are selected and structured for specific applications within CHRT. The CDB contains both computerized data formatted for operation with a specific automated program and hard copy data used or developed as part of a manual operation.

Initially, during the conceptual and design phases of W.S. acquisition, the CDB is dependent on historical and estimated data. These initial data are gradually replaced by actual system information as acquisition proceeds from design to development. Thus, the CDB is improved in accuracy and detail throughout the W.S. acquisition process.

The CHRT methodology and CDB were successfully demonstrated in the advanced medium STOL transport (AMST) program. The task now is to transition this technology into use. In order to facilitate this process, we currently are developing the necessary guidance documents, specifications and user training programs.

Both the Navy and the Army also now have programs in this area. In 1977, the Navy established a Project HARDMAN development office. HARDMAN stands for Military Manpower versus Hardware Procurement, and its goal is to develop institutional mechanisms for effectively considering manpower factors early in the system development cycle, before design lock-in occurs. More recently, the Army Research Institute (ARI) has established a program in this area under the general theme of personnel affordability.

All of these service projects, although their emphasis and approach are somewhat different, have as their objective the development and demonstration of an integrated methodology whereby considerations of human resources support can play a role in shaping W.S. design and support planning decisions. For more information on these three programs, I refer you to the Second Quarter 1980 issue of the Defense Management Journal where each of them is described in more detail.

I mentioned earlier, that the relatively low level of technical and management interest in this area of R&D had slowed the development and testing of needed tools and techniques. Nevertheless, as I have just indicated, some good work has been done, and a body of usable technology now exists and is ready for application. The benefits which can be realized from such application are considerable (Viewgraph 6).

Requirements for Achieving Technology Application

But in spite of the obvious benefits, achieving such application will not be an easy task. There are many problems and difficulties which must be overcome. What remains to be done before manpower factors can assume their proper role in the W.S. design and acquisition program? Let me mention a few of the things that are immediately apparent to me.

First, it is important for us to realize that the W.S. acquisition process is highly institutionalized and resistant to major change. It has traditionally operated on the philosophy that manpower and logistic factors are things to be considered after the engineers have done their job; the engineer designs the hardware and then the manpower and logistic people come along to provide the support resources required to operate and maintain the system. This picture, while certainly overdrawn, has more truth to it than many would care to admit.

The idea of manpower and logistic factors being actively involved in the design process from the conceptual phase on; the idea of designing to externally established manpower constraints; the idea of increasing acquisition costs, or even decreasing system performance, in order to gain some advantage in system supportability in the future -- these ideas are not accepted easily in the W.S. acquisition world. It will undoubtedly take considerable time and the operation of many forces to produce the necessary changes. Some of these forces are pretty much beyond our control, such as DoD policies and directives; selection and training of personnel to staff W.S. program offices; and the weight given to various factors in the Defense Systems Acquisition Review Council (DSARC) reviews. We can lobby in these areas, but our leverage is not great. There are some things we can do, however, to help bring about the necessary changes. We can provide clear, cogent demonstrations of the technical feasibility and effectiveness of integrating manpower and logistics factors into the W.S. development process. Particularly important will be hard data on the costs of applying the technology and the benefits to be derived. Also, it will be important to have documented examples of the negative consequences which have occurred as a result of failure to properly consider manpower and logistics factors. If we have these kinds of data, we can make a strong case. We have been very weak in this area, and we must do a better job in the future.

Second, it is imperative that the human factors engineering (HFE) people and the integrated logistic support (ILS) people begin to work together. Both ILS and HFE are mandated as a part of W.S. acquisition programs, and there are obviously close relationships between the two areas. If one reads the Air Force Regulations applicable to these two programs, it is clear that there are overlapping responsibilities for at least the elements shown on this viewgraph (Viewgraph 7) as they impact and are impacted by system design and support planning decisions; manpower and personnel; training and training equipment; maintenance technical data; and test and evaluation as they relate to these factors. The need to integrate HFE and ILS activities is briefly noted in AFR 800-15 (HFE), but in reality the two programs as yet have achieved little integration. It is clear to me that HFE and ILS personnel must join forces in order to provide a technology and an applications capability for including manpower and related support considerations in the design and modification of systems and equipment. This is a matter which must receive high priority both within the military services and the associated aerospace industries. I am happy to report that the Air Force has recently completed an intensive study of the HFE program, and that the need for a closer relationship between HFE and ILS was addressed in that study. The extent to which the recommendations of that study will be implemented remains to be seen.

A side benefit of a closer relationship between HFE and ILS will be the stimulus it provides for broadening our technology to encompass other elements of product support. Today, we have been discussing tools and techniques for incorporating manpower factors into W.S. design and acquisition. The three service projects I briefly described (CHRT, HARDMAN and Personnel Affordability) deal mainly with these factors. But a truly effective technology for building supportability into systems and equipment requires that we be able to make

trade-offs, during acquisition, among all of the factors that drive support requirements and costs, not just those related to manpower. It is clear, for example, that manpower requirements are affected by decisions on support equipment; by decisions on level of repair; and by decisions on spares provisioning. We need tools and techniques which allow one to consider all related support factors interactively during acquisition. Until such a capability is developed, we will be playing the suboptimization game and will be chasing problems and costs from one element to another, rather than arriving at an optimum design for supportability.

A third thing we need to do is to improve our understanding of the motives which influence the decisions and actions of W.S. contractors and government system program offices. If we want contractor and SPO personnel to give more weight to manpower factors in the W.S. acquisition process, we need to provide a motivational environment that makes such behavior more likely. This may sound simple, but I am afraid we really don't know very much about this topic. It generally has been assumed, for example, that contractors are primarily motivated by profit, and most of the incentive fee type contracts have been based upon this assumption. But the evidence seems to show that business institutions competing for and performing contracts involving unique products and services, such as the aerospace industry, are often motivated by other things than profit, at least in the short term. We need to get a lot smarter in this area before we can effectively use incentives to increase the attention given by W.S. contractors to manpower and related support considerations. We know perhaps even less about the complex motives which guide the decisions of SPO management personnel. Nevertheless, most of us would probably agree that there have been few incentives for emphasizing manpower related considerations. Why, for example, should a program manager spend scarce resources on training impact studies, whose benefits will appear far in the future in the ownership cost category, when all of the management hierarchy is looking at current growth in the production of fly-away cost of the system? Although these are touchy issues, they need to be addressed if we are to provide appropriate incentives for giving proper weight to W.S. supportability.

One thing we can be sure of is that more attention needs to be given to manpower and logistics factors during W.S. test and evaluation if we expect managers and engineers to give more attention to these factors during design and development. There is an old maxim in the field of education that, no matter how rigorously we define our course objectives, we tend to teach what is tested. I think that same general idea applies to the W.S. acquisition process. Priority and attention will be given to those areas where rigorous testing permits the quantitative comparison of design goals against performance achieved. A sophisticated technology exists for assessing hardware performance during test and evaluation. In the test and evaluation of aircraft, for example, large instrumented ranges, sophisticated sensing equipment, telemetering facilities and extensive data analysis capabilities are available to support a thorough evaluation of aircraft and engine performance on a wide variety of parameters. Furthermore, adequate time and resources are allocated to accomplishing the required testing. It seems to me, we need

that same kind of effort in the manpower and related support areas. There is a great need to develop improved tools and techniques for test and evaluation in the area of W.S. support and to allocate sufficient time and resources to assess the adequacy of support related design parameters, manpower, support concepts, and resources to meet system readiness goals. Until we do a better job during test and evaluation, we will have a difficult time motivating people in the earlier phases of W.S. acquisition.

Some Positive Signs

I have been talking about the problems and difficulties which must be overcome before we can hope to obtain widespread application of our technology, but I would like to close on a positive note. There are some favorable signs that manpower factors are beginning to receive the attention they deserve in the W.S. acquisition process. Let me mention four of them.

First, the attitude toward considering supportability as a major factor in W.S. acquisition really seems to be changing. As DoD's Robert Pirie said in a speech last year, "Where once there was lip service or benign neglect, there is now genuine interest and support." One way this increased interest and support have shown up has been in the DSARC process. In a number of major systems which have gone through the DSARC process recently, support was the major issue. When that type of attention is given to supportability at the top level, the impact inevitably travels back down through the system and helps to reorder priorities.

Another favorable sign, at least in the Air Force, is that the logistics community has awakened to its need for R&D and has established a procedure for submitting logistics research needs to the various Air Force laboratories. These needs are addressing not only hardware issues but human resources and management issues as well as shown on this next viewgraph (Viewgraph 8). Largely in response to these logistics R&D requirements, the AFHRL has expanded its efforts in the logistics area and has established a Logistics and Technical Training Division to be responsible for this R&D program. The application of R&D resources to the field of logistics will begin to develop the technology base that has long been lacking, and an improved technology base is one of the keys to progress in this area.

A third favorable sign, again speaking from an Air Force perspective, is a greatly increased interest in applying feedback and lessons learned information to acquisition and modification programs. In May of this year, the Air Force issued a regulation in the acquisition management series (AFR 800-13) entitled "Air Force Feedback Policy." This regulation specifically requires managers of system acquisition and modification programs to use the feedback of experience to improve hardware and software and to avoid past mistakes. This regulation makes clear that feedback information is to be used not only to improve system performance but to reduce support costs. Earlier in this paper, I mentioned that regulations can establish policy but that procedures, tools and techniques are required in order to make that policy work. Fortunately, the Air Force has initiated a program to develop a Product Performance Feedback System (PPFS) which will be of assistance in

implementing the Air Force policy. The ultimate objective of the PPFS effort is to provide a convenient, usable source of design related operating and support data using uniform methods and definitions throughout the life cycle. The data will be used by the Government and contractors in development, acquisition, operation, support and improvement of new and operational systems, to include subsystems, equipment and munitions. This program will be a major undertaking with great potential for improving the supportability of Air Force weapon systems. Of particular interest to us here on this Panel, the PPFS will provide a vehicle for codifying and storing manpower related experience with past systems and using that experience in new system development and modification programs. While AFLC is primarily responsible for the PPFS, the AFHRL is a major player and is developing a limited prototype to demonstrate the technical feasibility and effectiveness of such a data system. The prototype is limited in the sense that it will include only aircraft systems.

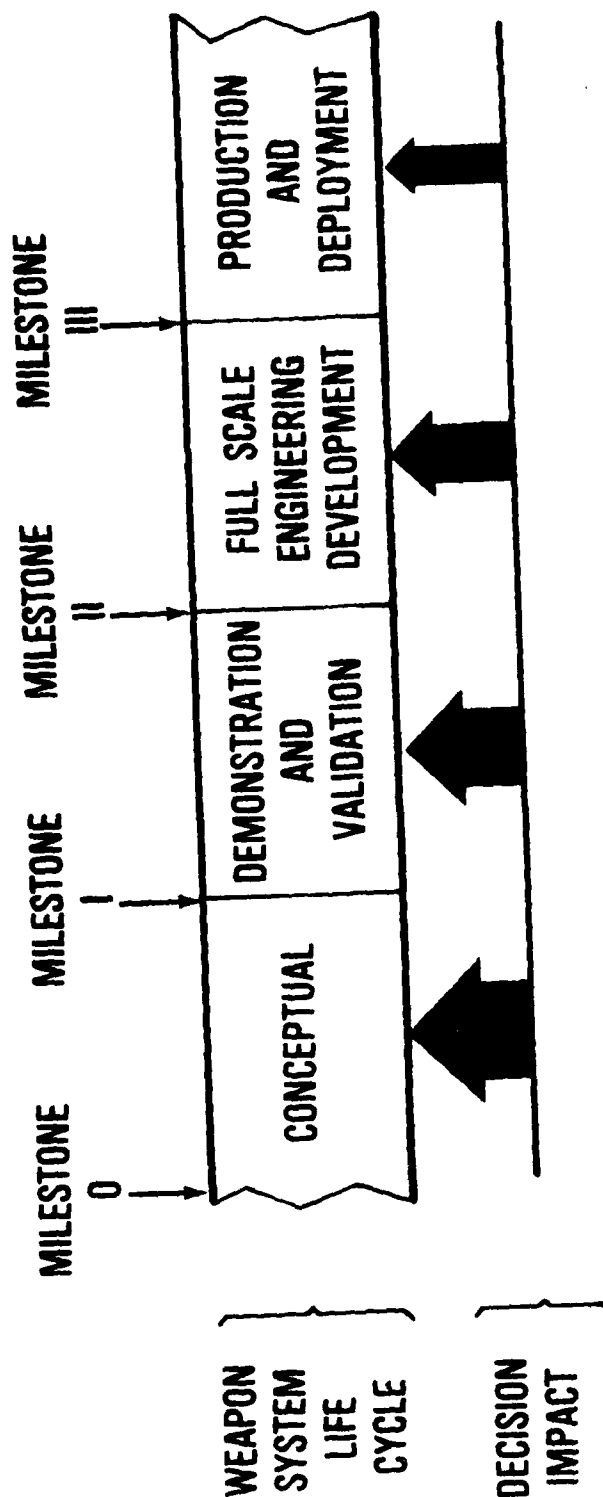
The final favorable sign I want to note, rests only on an impression. For that reason, I will mention it very briefly with the thought that we may be able to come back to it in our discussion period. My impression, from the documentation I see, is that there has been a significant increase in the number of Aerospace Industry Independent Research and Development (IR&D) projects which are addressing the issue of system supportability. Much of this work appears to be of high quality, and in many cases it complements nicely the government R&D work. If my impression about this increase in logistics related IR&D is true, it is a very encouraging trend which needs to be nurtured and reinforced. If my impression is not true, I hope you will inform me, and I will move this item back to my list of things which need to be done.

SUMMARY REMARKS

In drawing my remarks to a conclusion, let me briefly state the following (Viewgraph 9):

1. The general theme of this paper has been that many of the manpower, personnel and training requirements involved in the support of a W.S. have their genesis in W.S. design and support planning decisions. Therefore, it is at this point that they must be first addressed.
2. We have now a usable technology for integrating manpower, personnel and training factors into the W.S. development/modification process.
3. While there are some gaps and weak spots in the technology, its application to W.S. development and modification programs can be expected to make a major contribution to the acquisition of systems which can meet program readiness objectives within established manpower, personnel and training constraints.
4. Achieving this application is a formidable task, but one which merits the full support and best efforts of all of us in Government and the aerospace industry who are concerned with the impact of support requirements on system effectiveness and life cycle cost. There are some favorable signs that indicate the time may be right for a major effort.

DECISION IMPACT DURING ACQUISITION ON MANPOWER / LOGISTICS / COST



VIEWGRAPH 1

POLICY DOCUMENTS

OMB

OMB CIRCULAR A-109 APRIL 1976

DOD

0000 5000.1	MAJOR SYSTEMS ACQUISITIONS	JAN 1977
0000 5000.2	MAJOR SYSTEMS ACQUISITION PROCESS	JAN 1977
0000 5000.28	DESIGN TO COST	MAY 1975
0000 5000.39	ACQUISITION AND MANAGEMENT OF INTEGRATED LOGISTIC SUPPORT FOR SYSTEMS AND EQUIPMENT	JAN 1980
0ASD (MRA&L)	MEMO "MANPOWER AND LOGISTICS CON- CERNS FOR NEW MAJOR SYSTEMS"	AUG 1978
0ASD (MRA&L)	MEMO "MANPOWER ANALYSIS REQUIRE- MENTS FOR SYSTEMS ACQUISITION"	AUG 1978

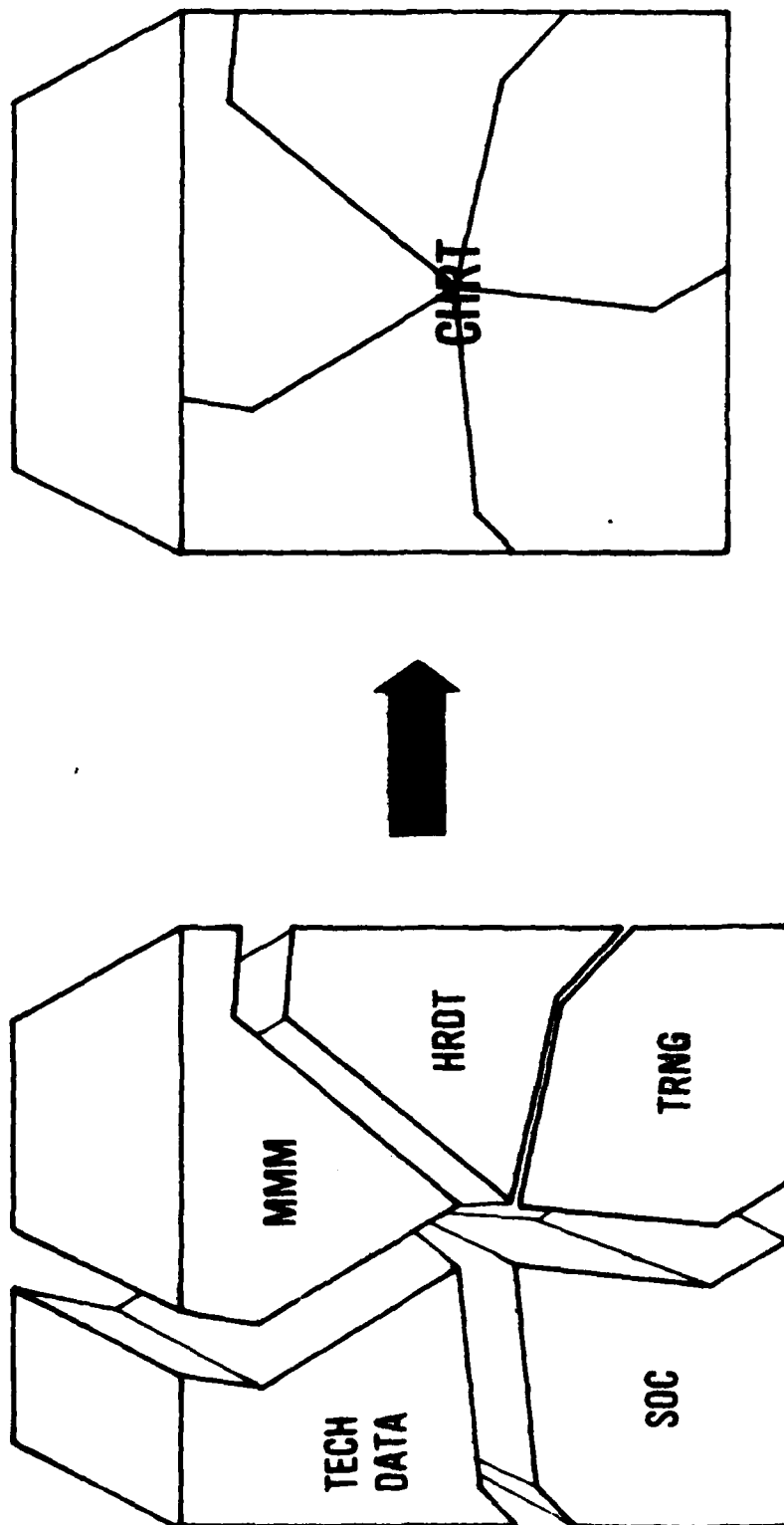
VIEWGRAPH 2

COMPONENT TECHNOLOGIES

- **MAINTENANCE MANPOWER MODELING**
- **TRAINING REQUIREMENTS AND PLANS**
- **MAINTENANCE TECHNICAL DATA**
- **SYSTEM OWNERSHIP COST**
- **HUMAN RESOURCES IN DESIGN TRADE-OFFS**
- **SUPPORTING DATA BASES**

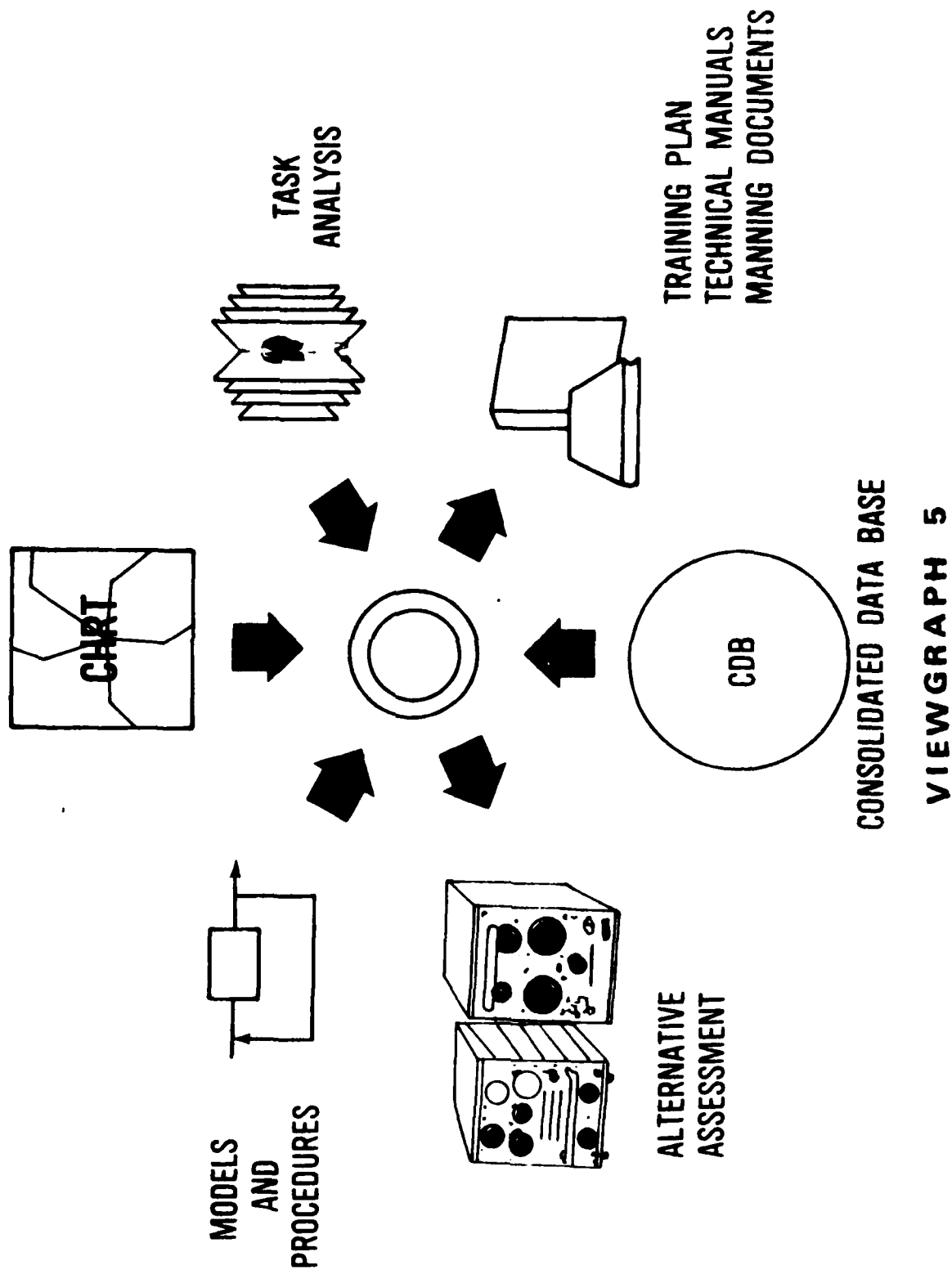
VIEWGRAPH 3

INTEGRATION OF TECHNOLOGIES



VIEWGRAPH 4

MAIN FEATURES OF THE CHRT METHODOLOGY



BENEFITS OF TECHNOLOGY

- **FACILITATES FRONT END SUPPORT ANALYSIS**
- **PROVIDES EARLY IDENTIFICATION OF HIGH DRIVERS OF SUPPORT RESOURCES**
- **GENERATES SUPPORT RESOURCE INPUTS FOR SYSTEM DESIGN AND SUPPORT PLANNING TRADE-OFFS**
- **CONTRIBUTES TO FORMULATION OF AN EFFECTIVE ILS PLAN AND DEVELOPMENT OF SUPPORT PRODUCTS**
- **PROVIDES CONTINUITY OF METHODOLOGY AND DATA BASES FROM CONCEPT THROUGH DEPLOYMENT**

VIEWGRAPH 6

OVERLAP BETWEEN HFE AND ILS

ILS

- MANPOWER REQUIREMENTS AND PERSONNEL
- TRAINING AND TRAINING SUPPORT
- TECHNICAL DATA
- ILS TEST AND EVAL

HFE

- MANPOWER AND PERSONNEL REQUIREMENTS
- TRAINING (INCLUDING TRNG PLAN, TRNG EQUIPMENT AND FACILITIES; MAINTENANCE TECH DATA)
- HF TEST AND EVALUATION

SELECTED LOGISTICS NEEDS

- **SYSTEMS DESIGN FOR SUPPORTABILITY**
- **PROCEDURES FOR O & S ANALYSIS DURING ACQUISITION**
- **APPLICATION AND IDENTIFICATION OF TOOLS FOR USE IN LOGISTICS SUPPORT ANALYSIS PROCESS**
- **TRADEOFFS AMONG TRAINED MANPOWER, AUTOMATED TEST EQUIPMENT AND TECHNICAL DATA**
- **ANALYSIS AND MANAGEMENT OF SYSTEM MANPOWER REQUIREMENTS**

VIEWGRAPH 8

SUMMARY

- CONTROL OF MANPOWER RELATED SUPPORT REQUIREMENTS MUST BEGIN DURING W.S. DEVELOPMENT
- A USABLE TECHNOLOGY EXISTS FOR DOING THIS
- APPLICATION OF THIS TECHNOLOGY CAN ASSIST IN DEVELOPING EFFECTIVE YET AFFORDABLE SYSTEMS
- ACHIEVING APPLICATION IS A FORMIDABLE TASK

VIEWGRAPH 9